Socio-technical Infrastructure Norms for Fair Use of Artificially Intelligent Education Companions: A Work in Progress

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Abstract: Use of artificially intelligent companions in education is widely appealing to learners, educational institutions, and the education technology sector. However, the use of such technology is not inherently fair, with issues such as cost, integration, security, privacy, opportunity, ethics, learning goals influencing their ability to empower and support learners. A framework to support a cross-disciplinary dialogue about the socio-technological infrastructure surrounding companions, to develop fair use implementation, is proposed.

Keywords: Guidelines, norms, educational companions, socio-technical infrastructure, ethics

1. Introduction

Drawing on a work in progress, the socio-technical infrastructure needed for fair use of educational technology (ed-tech), artificial companions are considered as an illustration of use of these developing norms. The purpose of socio-technical infrastructure is to ensure the use of technology, e.g., artificial companions, is appropriate i.e., ethical, moral and secure. Consideration of socio-technical infrastructure proactively provides support for the translation of research, in educational technologies and technology supported pedagogy, to innovation in practical educational environments.

Socio-technical infrastructure is a wide-reaching topic, the first section of this paper briefly describes key areas of infrastructure in relation to the educational technology. The second section describes an emerging framework of norms that support realizing innovation in the field of technologies within education. The final section illustrates framing a strategic dialogue in relation to artificially intelligent agents to be initiated with the ed-tech development, education and student communities.

2. What is socio-technical infrastructure and why does it matter?

Infrastructure provides a framework supporting development. Social infrastructure is a subsector of infrastructure, with its focus on utility equipment, public infrastructure, and vital objects (Grum and Grum, 2020). Social infrastructure also extends to more than the physical resources, strong social infrastructures create strong communities with resilience and the foundations for growth in both economic capital and social justice (Watson et al., 2015).

Within our context, the social infrastructure connection between internet providers, technology and educational organizations is the community under examination. With education being an essential service (UNESCO, n.d.), online education having been widespread and essential (as proven 2019 to 2022), educational technologies being at the heart of the future of education (Park, Kwon & Chung 2021), the continued massive expansion of the ed-tech sector (Hyneman, 2001), and the emergence of AI-Ed, the connections between education and technology matter more than ever in contributing to social success. The complexity of this context, with stakeholders from diverse backgrounds, makes it important to consider the future of education with clear expectations of how educational technology should be used (Dignum 2021, Institute for Ethical AI in Education 2022, Tzimas & Demetriadis 2021).

3. Framework for fair use of educational technologies – a work in progress

At this point in the larger framework project, developing an understanding of the norms that underpin fair use of educational technologies, is a work in progress. In this paper we consider the proposed norms in summary, and then as a frame for dialogue in relation to artificially intelligent companions. As this framework, and its proposed norms, are a work in progress, each must ultimately be tested. Viewing each through a lens of ethicality, morality and security will be a test of sufficiency to form the framework's foundation. Other tests are to be determined.

Norms are "an accepted standard or way of behaving or doing things that most people agree with." By employing foreshadowed norms to structure this framework we encourage general acceptance leading to a "situation or type of behavior that is expected or considered typical". (Cambridge Dictionary n.d.) i.e., a standard with some level of near future requirements is set by example rather than focusing on barriers to be overcome.

3.1 Norm One: Educational technologies must be supported by reliable access to the internet

Physical infrastructure that supports ubiquitous and reliable access to the internet is often implied as already satisfied in discussions about educational technologies; it, of course, is not (https://data.oecd.org/ict/internet-access.html and Ingram et al. 2021). Some would say this is a governmental issue (e.g., Institute for Ethical AI in Education 2022), or one of public private partnerships between internet, technology companies and educational institutions whilst acknowledging they also have risks (McShane, 2019). If this first norm cannot be satisfied, this is a barrier to educational equity and is now the limiter to advancing education in any community. It must become a priority, possibly halting other ed-tech innovation. Advocacy for and policy changes in support of wide-reaching physical infrastructure for reliable internet are an essential first norm to be satisfied and require action.

Considerations herein assumes that the first norm of the future, physical infrastructure that supports ubiquitous and reliable access to the internet, is satisfied

3.2 Norm Two: Affordable and equitable access to high speed internet services.

Low bandwidth and low speed internet also limit innovation using ed-tech. Access to high speed internet and the services and applications that require it, become our second norm. Much innovation in ed-tech presupposes connectivity, bandwidth and speed that will support constant interaction and video streaming, for example, AR/VR will become part of the normal and place additional demands on internet loads.

Reaching this norm is currently an active challenge in many areas; for example in the province of Alberta, Canada an educational technology group Cybera (2021) reports only about 37% of rural homes meet a basic service speed that would be required for education (the Canadian federal government's specified 50 Mbps download and 1 Mbps upload). These figures mean 63% of rural Albertan homes do not have internet that can support high quality online education.

3.3 Norm Three: Affordable and equitable access to educational technology

Technologies that support education vary in complexity and cost, from free open source systems to specialized systems with specialized price tags. Regardless of the product price-tag, staffing costs to support the operation of ed-tech in operation, especially if they become an integral part of an existing education system can be high. For institutions, evolution of current content management and enterprise data systems to allow integration of other technologies may pose technical and security risks, and political challenges, in addition to the cost of procurement and operations.

In the near future information delivery and discovery experiences will be augmented, incorporating AR/VR/virtual worlds. For example: medicine and dentistry are embracing teaching and assessment via computer-aided instruction, virtual patients, augmented reality, human patient simulations, and virtual reality for the assessment of students' competency. (Park, Kwon & Chung 2021). There will be many

opportunities for virtuality to become a norm in education. Boards of Education will need technology partners to effectively manage both technological requirements and cost.

The issues of equity between those that readily have resources (well-funded private institutions) and those that don't, is one of time as well as fund; those ready to take on the opportunity provide their students with support and advantages sooner. Does a baseline of service access need to be provided at some point in the future? Planning for the opportunity can happen well advance of the funds being needed, thus minimizing the opportunity lag. The potential for cross communications between the tech sector, government and the education section could see some socially responsible pricing models or sponsorship advocated around all of the practical issues of access to ed-tech.

3.4 Norm Four: Unrestricted access to one's own data

This proposed norm is an ethical and moral change to the current practices of harvested data. This norm proposes ownership sits with the individual rather than the system owner or software provider. Although GDPR and cookie permissions are a good step forward in raising awareness about data harvesting and personal data use, even these initiatives follow an opt out approach to permissions regarding data harvesting and do not provide easy to access opportunity access one's own data. The educational environment, however, presents a different situation than general browsing or social posting data. In an educational environment one's own data, and analytics on one's data, could be extremely helpful in learning as input to systems providing personalized content and personalized learning environments and near continuous feedback (Gosch et al 2021).

Security and privacy needs are an essential part of norms about learner data. Schools may no longer be the end repository for learner data, the software itself may store cloud copies as part of its functionality or data is archived to the cloud. In addition to security, levels of privacy must be clear to the learner, data sharing with the system to support the learner is not the same as data archiving post learner event or data sharing with other people.

3.5 Norm Five: Controlled access to leaners' data

Learning data (opposed to student registration or demographic data) is personal rather than institutional data. In addition to existent norms around security, privacy should be an active consideration. A norm of controlled access is a way to realize privacy for the many situations in which learner data should be shared. For example, success in learning may result in the learner needing to adapt the systems or be provided with teacher support when technology feedback is insufficient for learners to get the most from their data (Tsai et al 2020). To achieve adaptation and ongoing contextual as well as technical support learners will need to permit access to their data to others.

Additionally, personal data collected for use by a learner for the sole purposes of informing personal learning has inherent issues that influence the purpose for which they can be validly used in a wider or summary context.

* ★ Currency - As learning is an evolutionary and dynamic process, captured data may have a short currency. Data may only apply to the learner's capability within a relatively short time frame.
* ★ Relevancy – Experimentation or taking risks can elevate learning, some learning applications can provide opportunity to try out ideas and receive immediate feedback. Learning data created this way is informative about learning strategies but not necessarily the foundational knowledge of the leaner.

Consideration of who else may access learner data and why access should be granted from a primarily ethical perspective. Other stakeholders in an individual's education (teachers, parents, school management and school boards) may have legitimate need to access learner data. The norm should however be that of making a rationale for leaner data access and use and ensuring transparency of use for example, ethical use of learning analytics (Tzimas & Demetriadis 2021). University's have well established research controls for data and this can be extended to provide ethical guidance for use of institutional data by the organization. K-12 should mirror this approach of control.

3.6 Norm Six: Quality and ethical assurance of educational applications

Matching the needs of learners and educators to educational technologies and their applications is becoming more complex as the market of ed-tech grows. Additionally, leaners and educational organizations have more nuanced needs, impacted by many of the variables raised above (e.g., cost, integration, security, privacy, opportunity, ethics, learning goals). A more supportive cross disciplinary procurement and support process is needed to ensure technologies are fit for purpose for learners, educators and their organizations. Ideally, leaners have opportunities to engage in participatory design with technology development companies. Learners should at the very least be included in participatory design for the local implementation / installation of these systems and their situational set up. In the UK, Institute for Ethical AI in Education go further in their ethical guidance which reflects learner autonomy, as a key purpose, "AI systems should be used to increase the level of control that learners have over their learning and development" (Institute for Ethical AI in Education, 2022).

In summary, in the context of this paper, dialogue in support of the first three norms should focus on understanding the situational context of the learners and the educators with respect to access to internet service: location, reliability (and maintenance of), speed of services and the technologies and applications available to them. Dialogue in support of the fourth, fifth and sixth norms should focus on placing the learner at the center of companion use.

4. Framing a dialogue: illustration with artificial companion technologies

The work presented in this paper is a work in progress. It will, with development, become a frame against which to encourage dialogue with stakeholders in K-12 and postsecondary education, acknowledging the possibility that their needs may be different as well as overlapping. At a time when the extended use of technology (especially AI based technologies) is becoming ubiquitous, supports for education about these technologies and the techniques underpinning them is lagging behind their use; guidance to ensure appropriate deployment of innovation is rapidly needed. A foundation for cross discipline communication is essential in ensure enough realistic (i.e., accurate and informed) dialogue is occurring between software engineers, AI engineers, educators right through the educational system and learners.

In this work-in-progress form, initial considerations of the dialogue about artificially intelligent companions in education is made. We can conceive conversation starting points for this cross discipline dialogue from the perspective of three stakeholder communities, shown in table 1.

Table 1. *Cross-discipline dialogue frame*

Norms 1, 2, 3 - situational context of the learners and the educators with respect to access to internet service	Norms 4, 5, 6 – placing the learner at the centre of companion use
Learners and Educators	
Questions that support learners to articulate their current access to	A range of questions can be framed to assist learners in self-advocacy around their use of artificially intelligent companions. For

internet and computing technology and access issues they experience.	example, • How will the companion help leaners meet their educational goals? • How does the companion adapt to learner needs? • Is there ongoing support of learners to get the most from their companion? Questions to build understanding about privacy of learner data, for example: • Who has access to learner data? What are the organisational policy and procedures that control access to learner data? • Where will learner data be held? Under what circumstances does data continue to be held, and are no longer held? • How will learner data used by the system?
Educators and Educational Institutions	
Questions that assess if the institution and its learners technically enabled for adopting educational companions and what can be done if they are not, for example, what are the needs for partnerships to support the technological infrastructure, access to, and design of artificial companions?	Questions around how the institution will manage the change and adoption of this new technology and concerns and impacts on its learners and other stakeholders. Reference to preparation for the change, for example, organizational policy and procedures that control access to learner data take into account socio-ethical as well as technological needs of learner?
Developers/ Innovators/ Deployers of AI companions in education	
Investigation of corporate social responsibility in this sector. For example, is the institution prepared for companion technology, or what are the needs for partnerships to support the technological infrastructure, access to, and design of artificial companions?	Questions that show how learners have or can been involved in participatory design and testing of educational companions. Questions in support of an effective procurement of educational companion technologies, for example, what is available / being done to describe the requirements, capabilities, limitations and risks of applications offered? See model cards (Mitchell et al, 2019) for an example, to promote understanding of the technologies.

Next steps in promoting cross discipline dialogue for educational technologies include defining key terminology, curating a common language if you will, to support clear dialogue; a critique and development of the ideas proposed as norms to build and evolve a realistic framework to guide dialogue; and the development of policy friendly guidance for the uptake (procurement, deployment and use) of ed-tech. These guidelines should be cross disciplinary, having relevance to the technology development community as well as the educational community, i.e., in this article's context not solely focussing on use but also on companion capabilities.

5. Conclusions

Dialogue begins questioning, can this innovation be employed? Artificially intelligent companions in education are intended to empower and support learners. Use of norms provides a frame for cross

stakeholder communication to achieve these goals (empowerment and support) and protect learners data in the lifecycle of companion projects. Context of the learner environment informs the potential impact of the artificially intelligent companions in education i.e., internet access must be sufficient. Dialogue moves on to question should this innovation be employed? It includes an assessment of the value the innovation may bring and the impact its innovation may have. The benefits of artificially intelligent companions and their fitness for purpose for learners and educators should be part of the procurement process. Learner data is personal data that should be openly available to learners and have controlled use by others. As a work in progress, the proposed norms require substantial testing.

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